

AMENDMENTS TO THE SPECIFICATION

Delete the original pages containing Tables 1-23.

Insert between page 38 and page 39 the following pages including Tables 1-23.

Table 1

(Unit: Percent by mass)

Name of material	Quality	C	Si	Mn	P	S	Cu	Ni	Cr
Mild steel	A	0.036	<0.01	0.20	0.012	0.007	0.013	0.014	0.020
	B	0.010	<0.01	0.25	0.006	0.004	0.011	0.012	0.019
Cr-Mo alloy steel	C	0.025	0.50	1.14	0.003	0.007	0.012	0.084	1.39
	D	0.031	0.48	1.10	0.007	0.005	0.013	0.031	2.44

Table 2

(Unit: Percent by mass)

Name of material	Quality	Mo	Al	Ti	Nb	V	B	N	Mg
Mild steel	A	0.005	0.038	<0.002	0.003	<0.002	<0.0002	0.0024	<0.002
	B	0.002	0.008	<0.002	0.003	<0.002	<0.0002	0.0033	<0.002
Cr-Mo alloy steel	C	0.48	0.004	0.002	0.003	0.003	<0.0002	0.0080	<0.002
	D	1.10	0.002	<0.002	0.003	0.004	<0.0002	0.0090	<0.002

Table 3

Wire No.		Comparative example 1	Comparative example 2	Comparative example 3	Comparative example 4	Comparative example 5	Comparative example 6	Comparative example 7	Comparative example 8
Sheath quality		B	B	B	B	B	B	B	B
Flux ratio (% by mass)		17.0	17.0	17.0	14.0	14.0	16.0	16.0	16.0
Slag-forming material content (% by mass)		8.228	8.228	8.228	6.776	6.776	7.696	7.744	7.760
Composition (% by mass)	C	0.218	0.039	0.040	0.038	0.055	0.042	0.042	0.037
	Si	0.664	0.051	1.415	0.537	0.566	0.615	0.593	0.424
	Mn	1.451	1.381	1.387	0.541	1.623	1.369	1.373	1.364
	P	0.007	0.007	0.007	0.007	0.007	0.007	0.007	0.007
	S	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.005
	Cu	0.009	0.010	0.009	0.010	0.010	0.009	0.010	0.009
	Ni	0.010	0.010	0.010	0.010	0.010	0.010	0.010	0.010
	Cr	1.525	1.322	1.325	1.267	1.267	2.659	1.396	2.396
	Mo	0.503	0.502	0.502	0.413	0.413	0.953	0.292	1.524
	Al	Al (Sheath, alloy powder)	0.011	0.007	0.033	0.011	0.011	0.011	0.011
		Al ₂ O ₃ (Equivalent Al content)	0.045	0.045	0.045	0.037	0.037	0.028	0.043
		Total	0.056	0.052	0.078	0.048	0.048	0.039	0.053
	Nb	Ti	0.001	0.001	0.003	0.001	0.001	0.001	0.001
		Nb (Sheath, alloy powder)	0.002	0.002	0.002	0.002	0.002	0.002	0.002
		Nb ₂ O ₃ (Equivalent Nb content)	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	V	Total	0.002	0.002	0.002	0.002	0.002	0.002	0.002
		V (Sheath, alloy powder)	0.001	0.001	0.001	0.001	0.001	0.001	0.001
		V ₂ O ₃ (Equivalent V content)	0.004	0.004	0.004	0.003	0.003	0.003	0.003
	B	Total	0.005	0.005	0.005	0.004	0.004	0.004	0.004
		B (Sheath, alloy powder)	0.000	0.000	0.000	0.000	0.000	0.000	0.000
		B ₂ O ₃ (Equivalent B content)	0.008	0.008	0.008	0.007	0.007	0.008	0.007
	N	Total	0.008	0.008	0.008	0.007	0.007	0.008	0.007
		N	0.014	0.015	0.015	0.013	0.013	0.014	0.014
		Mg	0.798	0.798	0.798	0.657	0.657	0.751	0.639
	Zr	Zr	0.000	0.000	0.000	0.000	0.000	0.000	0.000
		TiO ₂	7.320	7.320	7.320	6.028	6.028	6.889	6.889
		SiO ₂	0.386	0.386	0.386	0.318	0.318	0.255	0.360
	Al ₂ O ₃	Al ₂ O ₃	0.085	0.085	0.085	0.070	0.070	0.052	0.080
		ZrO ₂	0.000	0.000	0.000	0.000	0.000	0.0000	0.011
		MgO	0.000	0.000	0.000	0.000	0.000	0.156	0.000
	V ₂ O ₅	V ₂ O ₅	0.007	0.007	0.007	0.005	0.005	0.006	0.006
		Nb ₂ O ₅	0.000	0.000	0.000	0.000	0.000	0.000	0.000
		Na ₂ O	0.050	0.050	0.050	0.041	0.041	0.042	0.044
	K ₂ O	K ₂ O	0.039	0.039	0.039	0.032	0.032	0.024	0.037
		CaO	0.000	0.000	0.000	0.000	0.000	0.002	0.000
		B ₂ O ₃	0.027	0.027	0.027	0.022	0.022	0.026	0.023
	NaF	NaF	0.000	0.000	0.000	0.000	0.000	0.075	0.045
		K ₂ SiF ₆	0.304	0.304	0.304	0.250	0.250	0.080	0.159
		CeF ₃	0.000	0.000	0.000	0.000	0.000	0.066	0.066
	CaF ₂	CaF ₂	0.000	0.000	0.000	0.000	0.000	0.000	0.016
		Total (Equivalent F content)	0.157	0.157	0.157	0.130	0.130	0.094	0.148
		Other elements	0.009	0.009	0.009	0.008	0.008	0.023	0.009
	Total Ti/N		313	287	290	276	277	287	285

Table 4

Wire No.		Comparative example 9	Comparative example 10	Comparative example 11	Comparative example 12	Comparative example 13	Comparative example 14	Comparative example 15
Sheath quality		B	B	B	B	B	B	B
Flux ratio (% by mass)		18.0	18.0	15.0	15.0	15.0	15.0	13.0
Slag-forming material content (% by mass)		8.334	8.712	6.795	7.245	6.795	6.495	7.072
Com- position (% by mass)	C	0.046	0.051	0.044	0.044	0.044	0.044	0.040
	Si	0.670	0.459	0.383	0.383	0.383	0.383	0.329
	Mn	0.975	1.520	1.310	1.309	1.310	1.311	1.204
	P	0.007	0.007	0.007	0.007	0.007	0.008	0.007
	S	0.005	0.005	0.005	0.005	0.005	0.005	0.004
	Cu	0.010	0.009	0.010	0.010	0.010	0.010	0.010
	Ni	0.010	0.010	0.010	0.010	0.010	0.010	0.010
	Cr	1.568	1.623	1.356	1.356	1.356	1.356	1.157
	Mo	0.565	0.531	0.443	0.443	0.443	0.443	0.384
	Al	Al (Sheath, alloy powder)	0.020	0.465	0.007	0.007	0.007	0.007
		Al ₂ O ₃ (Equivalent Al content)	0.490	0.048	0.040	0.047	0.040	0.033
		Total	0.510	0.513	0.047	0.054	0.047	0.040
	Nb	Ti	0.001	0.001	0.001	0.001	0.001	0.001
		Nb (Sheath, alloy powder)	0.002	0.002	0.016	0.009	0.002	0.002
		Nb ₂ O ₅ (Equivalent Nb content)	0.000	0.000	0.001	0.008	0.001	0.000
	V	Total	0.002	0.002	0.017	0.017	0.003	0.002
		V (Sheath, alloy powder)	0.001	0.001	0.001	0.001	0.013	0.001
		V ₂ O ₅ (Equivalent V content)	0.003	0.004	0.005	0.012	0.005	0.003
	B	Total	0.004	0.005	0.006	0.013	0.018	0.004
		B (Sheath, alloy powder)	0.000	0.000	0.000	0.000	0.000	0.000
		B ₂ O ₃ (Equivalent B content)	0.009	0.009	0.007	0.007	0.007	0.000
	Total	Total	0.009	0.009	0.007	0.007	0.007	0.000
		N	0.016	0.016	0.014	0.014	0.014	0.010
		Mg	0.845	0.845	0.704	0.599	0.704	1.169
	Zr	Zr	0.000	0.000	0.000	0.000	0.000	0.000
		TiO ₂	6.474	7.750	5.967	5.083	5.967	6.494
		SiO ₂	0.457	0.409	0.849	1.558	0.349	0.234
	Al ₂ O ₃	Al ₂ O ₃	0.927	0.090	0.075	0.088	0.075	0.062
		ZrO ₂	0.000	0.000	0.000	0.000	0.000	0.000
		MgO	0.000	0.000	0.000	0.000	0.000	0.000
	V ₂ O ₅	V ₂ O ₅	0.006	0.007	0.008	0.021	0.008	0.006
		Nb ₂ O ₅	0.000	0.000	0.002	0.011	0.002	0.000
		Na ₂ O	0.059	0.053	0.044	0.044	0.044	0.012
	K ₂ O	K ₂ O	0.047	0.041	0.035	0.036	0.035	0.028
		CaO	0.000	0.000	0.000	0.000	0.000	0.000
		B ₂ O ₃	0.029	0.029	0.024	0.024	0.024	0.000
	NaF	NaF	0.000	0.000	0.000	0.000	0.000	0.000
		K ₂ SiF ₆	0.322	0.322	0.268	0.268	0.268	0.233
		CeF ₃	0.000	0.000	0.000	0.000	0.000	0.000
	CaF ₂	CaF ₂	0.000	0.000	0.000	0.000	0.000	0.000
		Total (Equivalent F content)	0.167	0.167	0.139	0.139	0.139	0.120
		Other elements	0.013	0.010	0.023	0.112	0.023	0.004
	Total Ti/N		244	293	259	221	259	399

Table 5

Wire No.		Comparative example 16	Comparative example 17	Comparative example 18	Comparative example 19	Comparative example 20	Comparative example 21	Comparative example 22
Sheath quality		B	B	B	B	B	B	B
Flux ratio (% by mass)		13.0	13.0	13.0	13.0	15.0	15.5	14.0
Slag-forming material content (% by mass)		7.452	7.085	7.189	7.267	7.260	7.502	7.685
Com- position (% by mass)	C	0.040	0.040	0.039	0.040	0.044	0.045	0.042
	Si	0.329	0.329	0.321	0.362	0.383	0.394	0.359
	Mn	1.203	1.204	1.166	1.165	1.056	1.080	1.236
	P	0.007	0.007	0.007	0.007	0.007	0.007	0.007
	S	0.004	0.004	0.005	0.005	0.005	0.005	0.005
	Cu	0.010	0.010	0.010	0.010	0.010	0.010	0.010
	Ni	0.010	0.010	0.010	0.010	0.010	0.010	0.010
	Cr	1.157	1.157	1.102	1.377	1.356	1.392	1.281
	Mo	0.384	0.384	0.384	0.384	0.443	0.457	0.413
	Al	Al (Sheath, alloy powder)	0.007	0.010	0.007	0.007	0.007	0.007
		Al ₂ O ₃ (Equivalent Al content)	0.039	0.033	0.035	0.035	0.041	0.294
		Total	0.045	0.043	0.042	0.042	0.047	0.301
	Ti	Ti	0.001	0.001	0.001	0.001	0.001	0.001
		Nb (Sheath, alloy powder)	0.002	0.002	0.002	0.002	0.002	0.002
		Nb ₂ O ₃ (Equivalent Nb content)	0.000	0.000	0.000	0.000	0.000	0.000
	Nb	Total	0.002	0.002	0.002	0.002	0.002	0.002
		V (Sheath, alloy powder)	0.001	0.001	0.001	0.001	0.001	0.001
		V ₂ O ₃ (Equivalent V content)	0.003	0.003	0.003	0.003	0.003	0.002
	V	Total	0.004	0.004	0.004	0.004	0.004	0.003
		B (Sheath, alloy powder)	0.000	0.022	0.000	0.000	0.000	0.000
		B ₂ O ₃ (Equivalent B content)	0.022	0.001	0.005	0.006	0.007	0.008
	B	Total	0.022	0.023	0.006	0.006	0.007	0.008
		N	0.010	0.010	0.003	0.037	0.014	0.015
		Mg	1.169	1.169	0.519	0.519	0.180	0.657
	Zr	Zr	0.000	0.000	0.000	0.000	0.000	0.000
		TiO ₂	6.494	6.494	6.494	6.494	6.459	4.126
		SiO ₂	0.439	0.241	0.296	0.296	0.341	2.258
	Al ₂ O ₃	Al ₂ O ₃	0.074	0.062	0.066	0.066	0.075	0.556
		ZrO ₂	0.000	0.000	0.000	0.000	0.000	0.000
		MgO	0.000	0.000	0.000	0.000	0.000	0.000
	V ₂ O ₅	V ₂ O ₅	0.008	0.006	0.006	0.006	0.006	0.004
		Nb ₂ O ₅	0.000	0.000	0.000	0.000	0.000	0.000
		Na ₂ O	0.101	0.015	0.039	0.039	0.044	0.287
	K ₂ O	K ₂ O	0.035	0.028	0.030	0.030	0.035	0.198
		CaO	0.000	0.000	0.000	0.000	0.000	0.000
		B ₂ O ₃	0.069	0.002	0.021	0.021	0.024	0.025
	NaF	NaF	0.000	0.000	0.000	0.000	0.000	0.000
		K ₂ SiF ₆	0.233	0.233	0.233	0.233	0.268	0.250
		CeF ₃	0.000	0.000	0.000	0.032	0.000	0.000
	CaF ₂	CaF ₂	0.000	0.000	0.000	0.038	0.000	0.000
		Total (Equivalent F content)	0.120	0.120	0.120	0.148	0.139	0.130
		Other elements	0.012	0.004	0.006	0.013	0.008	0.082
	Total Ti/N		400	399	1326	105	280	166

Table 6

Wire No.		Comparative example 23	Comparative example 24	Comparative example 25	Comparative example 26	Comparative example 27	Comparative example 28	Comparative example 29
Sheath quality		B	B	B	B	B	B	B
Flux ratio (% by mass)		14.0	13.0	16.0	16.0	14.0	18.0	14.0
Slag-forming material content (% by mass)		9.002	7.644	8.848	7.744	6.874	8.694	8.035
Composition (% by mass)	C	0.034	0.040	0.046	0.047	0.042	0.047	0.041
	Si	0.367	0.332	0.395	0.049	0.360	0.325	0.343
	Mn	1.230	1.165	1.266	0.502	1.140	1.033	1.275
	P	0.006	0.007	0.007	0.006	0.007	0.007	0.007
	S	0.005	0.004	0.005	0.005	0.005	0.005	0.004
	Cu	0.010	0.010	0.010	0.010	0.010	0.010	0.010
	Ni	0.010	0.010	0.010	0.010	0.010	0.010	0.010
	Cr	1.356	1.178	1.396	1.378	1.281	1.153	1.292
	Mo	0.413	0.384	0.472	0.472	0.413	0.531	0.413
	Al	Al (Sheath, alloy powder)	0.013	0.007	0.007	0.007	0.465	0.007
		Al ₂ O ₃ (Equivalent Al content)	0.029	0.035	0.042	0.043	0.132	0.042
		Total	0.042	0.042	0.049	0.050	0.139	0.049
	Ti	0.001	0.001	0.001	0.001	0.001	0.001	0.001
	Nb	Nb (Sheath, alloy powder)	0.002	0.002	0.002	0.002	0.002	0.002
		Nb ₂ O ₃ (Equivalent Nb content)	0.000	0.000	0.000	0.000	0.000	0.000
		Total	0.002	0.002	0.002	0.002	0.002	0.002
	V	V (Sheath, alloy powder)	0.001	0.001	0.001	0.001	0.001	0.001
		V ₂ O ₃ (Equivalent V content)	0.004	0.004	0.004	0.003	0.002	0.004
		Total	0.005	0.005	0.005	0.004	0.003	0.005
	B	B (Sheath, alloy powder)	0.000	0.000	0.000	0.000	0.000	0.000
		B ₂ O ₃ (Equivalent B content)	0.008	0.006	0.007	0.008	0.008	0.023
		Total	0.008	0.006	0.007	0.008	0.008	0.023
	N	0.013	0.012	0.014	0.014	0.015	0.038	0.038
	Mg	0.559	0.610	0.639	0.799	0.657	0.845	1.259
	Zr	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	Slag-forming material	TiO ₂	8.322	7.143	7.193	6.889	4.126	7.750
		SiO ₂	0.271	0.289	0.355	0.363	1.042	0.473
		Al ₂ O ₃	0.055	0.065	0.080	0.080	0.249	0.079
		ZrO ₂	0.000	0.000	0.000	0.000	0.000	0.000
		MgO	0.000	0.000	0.000	0.000	0.000	0.000
		V ₂ O ₅	0.007	0.006	0.006	0.005	0.004	0.006
		Nb ₂ O ₅	0.000	0.000	0.000	0.000	0.000	0.000
		Na ₂ O	0.046	0.036	0.044	0.047	0.103	0.109
		K ₂ O	0.019	0.030	0.037	0.037	0.085	0.038
		CaO	0.000	0.000	0.000	0.000	0.000	0.000
		B ₂ O ₃	0.025	0.019	0.023	0.026	0.025	0.075
		NaF	0.000	0.000	0.000	0.000	0.606	0.000
		K ₂ SiF ₆	0.250	0.039	1.097	0.286	0.557	0.250
		CeF ₃	0.000	0.011	0.000	0.000	0.000	0.000
		CaF ₂	0.000	0.000	0.000	0.000	0.000	0.000
		Total (Equivalent F content)	0.130	0.023	0.568	0.148	0.562	0.130
		Other elements	0.006	0.007	0.013	0.009	0.078	0.013
		Total Ti/N	384	348	298	305	166	111

Table 7

Wire No.		Example 1	Example 2	Example 3	Example 4	Example 5	Example 6	Example 7
Sheath quality		A	B	B	B	B	B	B
Flux ratio (% by mass)		15.0	15.0	15.0	18.0	18.0	13.0	14.0
Slag-forming material content (% by mass)		7.260	7.260	7.245	8.910	8.910	6.565	7.140
Composition (% by mass)	C	0.170	0.035	0.037	0.044	0.043	0.035	0.036
	Si	0.487	0.073	0.841	0.417	0.271	0.357	0.379
	Mn	0.640	1.217	0.817	0.569	1.573	1.008	1.074
	P	0.012	0.006	0.007	0.007	0.007	0.007	0.006
	S	0.007	0.005	0.005	0.005	0.005	0.005	0.005
	Cu	0.011	0.010	0.010	0.010	0.010	0.010	0.010
	Ni	0.012	0.010	0.010	0.010	0.010	0.010	0.010
	Cr	1.125	1.293	1.294	1.548	1.548	2.524	0.113
	Mo	0.380	0.443	0.443	0.531	0.531	0.978	0.466
	Al	Al	0.033	0.007	0.022	0.007	0.007	0.007
		Al ₂ O ₃ (Equivalent Al content)	0.040	0.040	0.040	0.048	0.048	0.038
		Total	0.073	0.047	0.062	0.035	0.055	0.045
	Ti	0.001	0.001	0.002	0.001	0.001	0.001	0.001
	Nb	Nb	0.002	0.002	0.002	0.002	0.002	0.002
		Nb ₂ O ₅ (Equivalent Nb content)	0.000	0.000	0.000	0.000	0.000	0.000
		Total	0.002	0.002	0.002	0.002	0.002	0.002
	V	V	0.001	0.001	0.001	0.001	0.001	0.001
		V ₂ O ₅ (Equivalent V content)	0.008	0.003	0.003	0.004	0.004	0.003
		Total	0.004	0.004	0.004	0.005	0.005	0.004
	B	B	0.000	0.000	0.000	0.000	0.000	0.000
		B ₂ O ₃ (Equivalent B content)	0.007	0.007	0.007	0.009	0.009	0.007
		Total	0.007	0.007	0.007	0.009	0.009	0.007
	N	0.012	0.013	0.013	0.015	0.015	0.011	0.015
	Mg	0.599	0.599	0.599	0.719	0.719	0.519	0.559
	Zr	0.109	0.033	0.033	0.261	0.163	0.118	0.127
Slag-forming material	TiO ₂	6.459	6.459	5.994	7.553	7.553	5.455	5.874
	SiO ₂	0.341	0.341	0.341	0.467	0.467	0.301	0.324
	Al ₂ O ₃	0.075	0.075	0.075	0.090	0.090	0.066	0.071
	ZrO ₂	0.000	0.000	0.000	0.299	0.299	0.129	0.139
	MgO	0.000	0.000	0.000	0.000	0.000	0.250	0.269
	V ₂ O ₅	0.005	0.006	0.005	0.007	0.007	0.005	0.005
	Nb ₂ O ₅	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	Na ₂ O	0.044	0.044	0.044	0.053	0.053	0.039	0.041
	K ₂ O	0.035	0.035	0.035	0.041	0.041	0.030	0.032
	CaO	0.000	0.000	0.000	0.000	0.000	0.003	0.003
	B ₂ O ₃	0.024	0.024	0.024	0.029	0.029	0.022	0.023
	Fluoride compound	NaF	0.000	0.000	0.141	0.169	0.122	0.132
		K ₂ SiF ₆	0.268	0.268	0.119	0.143	0.103	0.111
		CeF ₃	0.000	0.000	0.374	0.000	0.000	0.058
		CaF ₂	0.000	0.000	0.000	0.035	0.025	0.027
		Total (Equivalent F content)	0.139	0.139	0.234	0.168	0.121	0.147
		Other elements	0.008	0.008	0.093	0.022	0.016	0.029
	Total Ti/N	320	301	281	306	307	286	234

Table 8

Wire No.		Example 8	Example 9	Example 10	Example 11	Example 12	Example 13	Example 14
Sheath quality		A	B	B	B	B	B	B
Flux ratio (% by mass)		17.0	16.0	16.0	13.0	15.5	15.5	15.5
Slag-forming material content (% by mass)		8.636	8.272	8.368	7.111	7.549	7.564	7.564
Com- position (% by mass)	C	0.064	0.048	0.047	0.040	0.045	0.045	0.046
	Si	0.462	0.624	0.536	0.404	0.526	0.393	0.532
	Mn	1.202	1.379	1.379	1.077	1.343	1.228	1.228
	P	0.011	0.007	0.007	0.007	0.007	0.007	0.007
	S	0.008	0.005	0.005	0.005	0.005	0.005	0.005
	Cu	0.011	0.010	0.010	0.010	0.010	0.010	0.010
	Ni	0.012	0.010	0.010	0.010	0.010	0.010	0.010
	Cr	2.482	1.445	1.278	1.158	1.280	1.214	1.354
	Mo	1.068	0.472	0.472	0.408	0.457	0.457	0.457
	Al	Al	0.032	0.167	0.007	0.007	0.007	0.007
		Al ₂ O ₃ (Equivalent Al content)	0.046	0.295	0.043	0.033	0.041	0.041
		Total	0.078	0.462	0.050	0.041	0.049	0.048
	Ti	0.072	0.068	0.068	0.001	0.286	0.066	0.066
	Nb	Nb	0.002	0.002	0.003	0.002	0.002	0.002
		Nb ₂ O ₃ (Equivalent Nb content)	0.000	0.000	0.003	0.000	0.000	0.000
		Total	0.002	0.002	0.006	0.002	0.002	0.002
	V	V	0.001	0.001	0.001	0.001	0.001	0.001
		V ₂ O ₃ (Equivalent V content)	0.004	0.003	0.007	0.003	0.003	0.003
		Total	0.005	0.004	0.008	0.004	0.004	0.004
	B	B	0.000	0.000	0.000	0.000	0.000	0.000
		B ₂ O ₃ (Equivalent B content)	0.009	0.008	0.008	0.002	0.008	0.009
		Total	0.009	0.008	0.008	0.002	0.018	0.009
	N	0.013	0.014	0.019	0.007	0.023	0.006	0.033
	Mg	0.849	0.751	0.751	0.234	0.728	0.728	0.728
	Zr	0.154	0.145	0.116	0.000	0.112	0.028	0.112
Slag-forming material	TiO ₂	7.133	6.889	7.135	6.494	6.674	6.674	6.674
	SiO ₂	0.394	0.363	0.384	0.255	0.352	0.360	0.360
	Al ₂ O ₃	0.086	0.568	0.080	0.063	0.078	0.078	0.078
	ZrO ₂	0.168	0.000	0.000	0.000	0.000	0.000	0.000
	MgO	0.326	0.000	0.156	0.000	0.000	0.000	0.000
	V ₂ O ₅	0.006	0.006	0.012	0.006	0.006	0.006	0.006
	Nb ₂ O ₅	0.000	0.000	0.004	0.000	0.000	0.000	0.000
	Na ₂ O	0.050	0.049	0.047	0.021	0.046	0.049	0.049
	K ₂ O	0.039	0.037	0.037	0.028	0.036	0.036	0.036
	CaO	0.004	0.000	0.002	0.000	0.000	0.000	0.000
	B ₂ O ₃	0.028	0.026	0.026	0.007	0.025	0.028	0.028
	Fluoride compound	NaF	0.160	0.000	0.000	0.000	0.000	0.000
		K ₂ SiF ₆	0.135	0.286	0.286	0.277	0.277	0.277
		CeF ₃	0.042	0.040	0.000	0.000	0.039	0.039
		CaF ₂	0.033	0.000	0.156	0.000	0.000	0.000
		Total (Equivalent F content)	0.171	0.160	0.224	0.120	0.155	0.155
	Other elements	0.030	0.017	0.042	0.005	0.016	0.017	0.017
	Total Ti/N	328	291	233	539	184	679	125

Table 9

Wire No.		Example 15	Example 16	Example 17	Example 18	Example 19	Example 20	Example 21
Sheath quality		B	A	B	B	B	B	B
Flux ratio (% by mass)		15.5	15.5	15.5	15.0	16.0	16.0	16.0
Slag-forming material content (% by mass)		7.649	7.502	7.146	8.730	7.512	8.592	6.256
Composition (% by mass)	C	0.040	0.060	0.044	0.043	0.046	0.046	0.049
	Si	0.556	0.388	0.354	0.342	0.396	0.396	0.365
	Mn	1.169	1.124	1.228	1.192	1.268	1.265	1.150
	P	0.007	0.011	0.007	0.007	0.007	0.007	0.007
	S	0.005	0.007	0.005	0.004	0.005	0.005	0.005
	Cu	0.010	0.011	0.010	0.010	0.010	0.010	0.010
	Ni	0.010	0.012	0.010	0.010	0.010	0.010	0.010
	Cr	1.351	1.362	1.280	1.239	1.396	1.396	1.321
	Mo	0.457	0.460	0.457	0.443	0.472	0.472	0.452
	Al	Al	0.007	0.032	0.007	0.007	0.007	0.007
		Al ₂ O ₃ (Equivalent Al content)	0.041	0.041	0.047	0.032	0.043	0.042
		Total	0.048	0.073	0.054	0.039	0.050	0.049
	Ti	0.163	0.033	0.098	0.126	0.034	0.201	0.034
	Nb	Nb	0.002	0.002	0.002	0.002	0.002	0.002
		Nb ₂ O ₃ (Equivalent Nb content)	0.000	0.000	0.000	0.000	0.000	0.000
		Total	0.002	0.002	0.002	0.002	0.002	0.002
	V	V	0.001	0.001	0.001	0.001	0.001	0.001
		V ₂ O ₃ (Equivalent V content)	0.003	0.003	0.002	0.004	0.003	0.003
		Total	0.004	0.004	0.003	0.005	0.004	0.004
	B	B	0.000	0.000	0.000	0.000	0.000	0.000
		B ₂ O ₃ (Equivalent B content)	0.008	0.008	0.009	0.007	0.008	0.008
		Total	0.008	0.008	0.009	0.007	0.008	0.008
	N	0.008	0.007	0.023	0.023	0.015	0.014	0.024
	Mg	0.232	1.487	0.728	0.704	0.751	0.761	0.799
	Zr	0.112	0.000	0.000	0.000	0.000	0.000	0.000
	Slag-forming material	TiO ₂	6.674	6.674	4.336	8.017	6.889	5.355
		SiO ₂	0.352	0.352	0.851	0.280	0.363	0.363
		Al ₂ O ₃	0.078	0.078	0.089	0.060	0.080	0.080
		ZrO ₂	0.000	0.000	0.936	0.000	0.000	0.000
		MgO	0.000	0.000	0.455	0.000	0.000	0.000
		V ₂ O ₅	0.006	0.006	0.004	0.007	0.006	0.005
		Nb ₂ O ₅	0.000	0.000	0.000	0.000	0.000	0.000
		Na ₂ O	0.046	0.046	0.052	0.041	0.047	0.047
		K ₂ O	0.036	0.036	0.041	0.027	0.037	0.037
		CaO	0.000	0.000	0.007	0.000	0.000	0.000
		B ₂ O ₃	0.026	0.025	0.028	0.024	0.026	0.026
		Fluoride compound	NaF	0.000	0.000	0.000	0.000	0.452
			K ₂ SiF ₆	0.277	0.277	0.277	0.268	0.557
			CeF ₃	0.039	0.000	0.039	0.000	0.007
			CaF ₂	0.000	0.000	0.000	0.000	0.047
			Total (Equivalent F content)	0.155	0.144	0.155	0.139	0.527
		Other elements	0.016	0.008	0.032	0.005	0.009	0.018
		Total Ti/N	517	558	115	218	287	135

Table 10

Wire No.		Example 22	Example 23	Example 24	Example 25	Example 26	Example 27	Example 28	
Sheath quality		B	C	C	C	C	A	B	
Flux ratio (% by mass)		18.0	15.0	17.0	15.0	12.0	16.0	14.0	
Slag-forming material content (% by mass)		9.720	7.260	7.701	6.793	6.636	7.744	6.804	
Com- position (% by mass)	C	0.054	0.049	0.051	0.048	0.043	0.068	0.043	
	Si	0.410	0.563	0.434	0.493	0.453	0.368	0.447	
	Mn	1.257	1.275	1.293	1.275	1.246	0.974	0.984	
	P	0.007	0.004	0.004	0.004	0.003	0.012	0.007	
	S	0.005	0.007	0.007	0.007	0.007	0.007	0.005	
	Cu	0.009	0.011	0.011	0.011	0.011	0.011	0.010	
	Ni	0.010	0.043	0.042	0.043	0.044	0.012	0.010	
	Cr	1.483	1.269	1.253	1.341	1.293	1.522	2.250	
	Mo	0.508	0.502	0.505	0.502	0.498	0.505	0.878	
	Al	Al	0.007	0.004	0.004	0.004	0.004	0.032	0.007
		Al ₂ O ₃ (Equivalent Al content)	0.038	0.040	0.045	0.040	0.032	0.043	0.037
		Total	0.045	0.044	0.049	0.043	0.036	0.075	0.044
	Ti	0.114	0.002	0.144	0.127	0.002	0.001	0.001	
	Nb	Nb	0.002	0.002	0.002	0.002	0.002	0.002	0.002
		Nb ₂ O ₃ (Equivalent Nb content)	0.000	0.000	0.000	0.000	0.000	0.000	0.000
		Total	0.002	0.002	0.002	0.002	0.002	0.002	0.002
	V	V	0.001	0.003	0.002	0.003	0.003	0.001	0.001
		V ₂ O ₃ (Equivalent V content)	0.004	0.003	0.003	0.003	0.003	0.003	0.003
		Total	0.005	0.006	0.005	0.006	0.006	0.004	0.004
	B	B	0.000	0.000	0.000	0.000	0.000	0.000	0.000
		B ₂ O ₃ (Equivalent B content)	0.009	0.007	0.008	0.007	0.006	0.008	0.008
		Total	0.009	0.007	0.008	0.007	0.006	0.008	0.008
	N	0.027	0.018	0.019	0.027	0.016	0.023	0.019	
	Mg	0.899	0.674	0.764	0.674	0.539	0.799	0.699	
	Zr	0.000	0.081	0.000	0.027	0.000	0.000	0.000	
	Slag -forming material	TiO ₂	7.912	6.459	6.793	5.994	5.994	6.889	5.594
		SiO ₂	0.624	0.341	0.386	0.341	0.273	0.363	0.374
		Al ₂ O ₃	0.071	0.075	0.085	0.075	0.061	0.080	0.071
		ZrO ₂	0.604	0.000	0.000	0.000	0.000	0.000	0.094
		MgO	0.000	0.000	0.000	0.000	0.000	0.000	0.133
		V ₂ O ₅	0.007	0.006	0.006	0.005	0.005	0.006	0.005
		Nb ₂ O ₅	0.000	0.000	0.000	0.000	0.000	0.000	0.000
		Na ₂ O	0.050	0.044	0.050	0.044	0.036	0.047	0.046
K ₂ O		0.033	0.035	0.039	0.035	0.028	0.037	0.030	
CaO		0.000	0.000	0.000	0.000	0.000	0.000	0.002	
B ₂ O ₃		0.029	0.024	0.027	0.024	0.019	0.026	0.025	
Fluoride compound		NaF	0.000	0.000	0.000	0.000	0.000	0.000	0.013
		K ₂ SiF ₆	0.322	0.268	0.304	0.268	0.215	0.286	0.250
		CeF ₃	0.045	0.000	0.000	0.000	0.000	0.000	0.116
		CaF ₂	0.000	0.000	0.000	0.000	0.000	0.000	0.014
		Total (Equivalent F content)	0.180	0.139	0.157	0.139	0.111	0.148	0.176
Other elements		0.024	0.008	0.010	0.008	0.006	0.009	0.035	
Total Ti/N		183	215	218	138	225	178	172	

Table 11

Wire No.		Example 29	Example 30	Example 31	Example 32	Example 33	Example 34	Example 35
Sheath quality		B	B	B	D	D	B	B
Flux ratio (% by mass)		15.0	15.0	15.5	16.0	14.0	13.0	15.0
Slag-forming material content (% by mass)		7.290	7.245	7.487	7.216	6.314	7.215	8.325
Com- position (% by mass)	C	0.051	0.059	0.062	0.055	0.052	0.044	0.050
	Si	0.663	0.461	0.518	0.463	0.465	0.471	0.606
	Mn	1.037	1.035	1.062	1.251	1.232	1.236	1.240
	P	0.007	0.007	0.007	0.007	0.007	0.007	0.007
	S	0.005	0.005	0.005	0.005	0.005	0.004	0.004
	Cu	0.010	0.010	0.009	0.012	0.012	0.010	0.010
	Ni	0.010	0.010	0.010	0.026	0.027	0.010	0.010
	Cr	2.338	2.338	2.416	2.134	2.173	1.178	1.282
	Mo	0.940	0.940	0.972	0.994	1.007	0.400	0.462
	Al	0.007	0.007	0.007	0.002	0.002	0.007	0.007
	Al ₂ O ₃ (Equivalent Al content)	0.040	0.039	0.041	0.042	0.036	0.035	0.041
	Total	0.047	0.046	0.048	0.044	0.038	0.042	0.048
	Ti	0.001	0.126	0.130	0.135	0.001	0.001	0.126
	Nb	0.002	0.002	0.002	0.002	0.002	0.002	0.002
	Nb ₂ O ₃ (Equivalent Nb content)	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	Total	0.002	0.002	0.002	0.002	0.002	0.002	0.002
	V	0.001	0.001	0.001	0.003	0.003	0.001	0.001
	V ₂ O ₃ (Equivalent V content)	0.003	0.003	0.003	0.003	0.003	0.003	0.004
	Total	0.004	0.004	0.004	0.006	0.006	0.004	0.005
	B	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	B ₂ O ₃ (Equivalent B content)	0.008	0.006	0.006	0.006	0.005	0.008	0.009
	Total	0.008	0.006	0.006	0.006	0.005	0.008	0.009
	N	0.021	0.021	0.021	0.018	0.017	0.010	0.010
	Mg	0.749	0.749	0.774	0.799	0.699	1.273	0.749
	Zr	0.136	0.000	0.028	0.029	0.025	0.094	0.163
	TiO ₂	5.994	5.994	6.194	6.394	5.594	6.494	7.493
	SiO ₂	0.401	0.378	0.390	0.347	0.304	0.309	0.357
	Al ₂ O ₃	0.076	0.074	0.077	0.079	0.069	0.066	0.077
	ZrO ₂	0.101	0.101	0.104	0.000	0.000	0.000	0.000
	MgO	0.143	0.143	0.148	0.000	0.000	0.000	0.000
	V ₂ O ₅	0.005	0.005	0.006	0.006	0.005	0.006	0.007
	Nb ₂ O ₅	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	Na ₂ O	0.050	0.040	0.041	0.042	0.037	0.044	0.051
	K ₂ O	0.032	0.031	0.032	0.033	0.029	0.030	0.035
	CaO	0.002	0.002	0.002	0.000	0.000	0.000	0.000
	B ₂ O ₃	0.027	0.019	0.020	0.020	0.017	0.025	0.029
	NaF	0.014	0.014	0.015	0.000	0.000	0.000	0.000
	K ₂ SiF ₆	0.268	0.268	0.277	0.286	0.250	0.233	0.268
	CeF ₃	0.125	0.125	0.129	0.000	0.000	0.000	0.000
	CaF ₂	0.015	0.015	0.015	0.000	0.000	0.000	0.000
	Total (Equivalent F content)	0.188	0.188	0.195	0.148	0.130	0.120	0.139
	Other elements	0.038	0.037	0.038	0.009	0.008	0.007	0.008
	Total Ti/N	174	180	181	215	194	400	450

Table 12

Welding current (A) (DCEP)	Arc voltage (V)	Welding speed (cm/min)	Welding position	Shielding gas flow rate (l/min)	Preheating and interpass temperature (°C)	Remarks
270	27 – 32	25 – 30	Flat position	Refer to tables for composition, Flow rate: 25	176 ± 15	2.25 Cr-1 Mo alloys 1.25 Cr-0.5 Mo alloys
					150 ± 15	0.5 Mo alloys

Table 13

Welding current (A) (DCEP)	Arc voltage (V)	Welding speed (cm/min)	Welding position	Shielding gas flow rate (l/min)	Preheating and interpass temperature (°C)	Remarks
180	22 – 26	20 – 30	Vertical position	Refer to tables for composition, Flow rate: 25	176 ± 15	2.25 Cr-1 Mo alloys 1.25 Cr-0.5 Mo alloys
					150 ± 15	0.5 Mo alloys

Table 14

Flux-cored wires	Conditions for acceptable tensile property			Conditions for acceptable impact performance 2 mmVE–18°C
	0.2%-Offset yield strength	Tensile strength	Elongation	
Comparative example 1 – 5, 7, 9 - 29	Min. 470 Mpa	560 – 690 Mpa	Min. 19%	55 J or above
Example 1 – 5, 9 – 27, 34, 35				
Comparative example 6, 8	Min. 540 Mpa	620 – 760 Mpa	Min. 17%	
Example 6, 8, 28 - 33				
Example 7	Min. 400 Mpa	480 – 620 Mpa	Min. 20%	

Example 7: 620°C x 1 hr, Furnace cooling
Others: 690°C x 1 hr, Furnace cooling

Table 15

Flux-cored wire	Comparative example 1	Comparative example 2	Comparative example 3	Comparative example 4	Comparative example 5	Comparative example 6	Comparative example 7	Comparative example 8
Designation of material of plates	A387 Gr.11 C1.2	A387 Gr.11 C1.2	A387 Gr.11 C1.2	A387 Gr.11 C1.2	A387 Gr.11 C1.2	A387 Gr.11 C1.2	A387 Gr.11 C1.2	A387 Gr.11 C1.2
Shielding gas	80%Ar+20%CO ₂	80%Ar+20%CO ₂	80%Ar+20%CO ₂	80%Ar+20%CO ₂	80%Ar+20%CO ₂	80%Ar+20%CO ₂	80%Ar+20%CO ₂	80%Ar+20%CO ₂
Chemical composition (% by mass)	C	0.209	0.048	0.049	0.045	0.066	0.051	0.045
	Si	0.73	0.06	1.56	0.58	0.62	0.68	0.47
	Mn	1.06	1.01	1.02	0.39	1.17	1.00	0.99
	P	0.007	0.007	0.008	0.007	0.007	0.007	0.007
	S	0.009	0.010	0.009	0.009	0.009	0.009	0.010
	Cu	0.015	0.015	0.015	0.015	0.015	0.015	0.014
	Ni	0.015	0.015	0.015	0.015	0.015	0.015	0.015
	Cr	1.48	1.28	1.28	1.21	1.21	1.35	2.31
	Mo	0.56	0.56	0.56	0.46	0.46	0.32	1.70
	Al	0.002	0.002	0.003	0.002	0.002	0.002	0.002
	Ti	0.101	0.048	0.215	0.039	0.155	0.094	0.094
	Nb	0.002	0.002	0.002	0.003	0.003	0.002	0.002
	V	0.009	0.009	0.009	0.007	0.007	0.007	0.007
	B	0.0049	0.0005	0.0049	0.0006	0.0040	0.0046	0.0041
	N	0.012	0.013	0.013	0.011	0.011	0.013	0.013
Usability.	Good	Bad	Good	Good	Good	Bad	Good	Good
Radiographic examination	JIS Class 1 or below (HC)	JIS Class 1 or below (BH)	JIS class 1	JIS Class 1 or below (BH)	JIS class 1	JIS class 1	JIS class 1	JIS class 1
Tensile strength (MPa)	732	572	728	541	740	775	545	769
0.2%-Offset yield strength (MPa)	602	475	612	445	642	583	444	560
Elongation (%)	21	24	20	28	18	19	22	21
2 mmVE-18°C (Avg. J)	33	14	13	19	22	21	53	33
Ferrite band suppression	Acceptable	Unacceptable	Acceptable	Unacceptable	Acceptable	Acceptable	Acceptable	Acceptable

*HC: Hot cracking, BH: Blow holes

Table 16

Flux-cored wire	Comparative example 9	Comparative example 10	Comparative example 11	Comparative example 12	Comparative example 13	Comparative example 14	Comparative example 15
Designation of material of plates	A387 Gr.11 C1.2	A387 Gr.11 C1.2	A387 Gr.11 C1.2	A387 Gr.11 C1.2	A387 Gr.11 C1.2	A387 Gr.11 C1.2	A387 Gr.11 C1.2
Shielding gas	80%Ar+20%CO ₂	80%Ar+20%CO ₂	80%Ar+20%CO ₂	80%Ar+20%CO ₂	80%Ar+20%CO ₂	80%Ar+20%CO ₂	80%Ar+20%CO ₂
Chemical composition (% by mass)	C	0.055	0.062	0.053	0.053	0.052	0.047
	Si	0.74	0.51	0.42	0.42	0.42	0.36
	Mn	0.72	1.12	0.95	0.95	0.94	0.37
	P	0.007	0.007	0.007	0.008	0.008	0.007
	S	0.009	0.009	0.009	0.009	0.010	0.009
	Cu	0.015	0.015	0.015	0.015	0.015	0.015
	Ni	0.015	0.015	0.015	0.015	0.015	0.015
	Cr	1.52	1.58	1.29	1.30	1.29	1.11
	Mo	0.63	0.60	0.49	0.49	0.49	0.42
	Al	0.022	0.022	0.002	0.002	0.002	0.002
	Ti	0.169	0.204	0.081	0.069	0.081	0.088
	Nb	0.002	0.002	0.019	0.018	0.003	0.003
	V	0.007	0.008	0.010	0.022	0.026	0.007
	B	0.0052	0.0052	0.0043	0.0043	0.0043	0.0000
	N	0.014	0.014	0.012	0.012	0.012	0.008
Test results	Usability,	Good	Good	Good	Good	Good	Good
	Radiographic examination*	JIS class 1	JIS class 1	JIS class 1	JIS class 1	JIS class 1	JIS class 1
	Tensile strength (MPa)	694	703	675	683	664	646
	0.2%-Offset yield strength (MPa)	597	599	590	595	559	558
	Elongation (%)	25	23	24	24	23	25
	2 mmVE-18°C (Avg. J)	5	7	11	13	25	9
	Ferrite band suppression	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable

Table 17

Flux-cored wire	Comparative example 16	Comparative example 17	Comparative example 18	Comparative example 19	Comparative example 20	Comparative example 21	Comparative example 22
Designation of material of plates	A387 Gr.11 C1.2	A387 Gr.11 C1.2	A387 Gr.11 C1.2	A387 Gr.11 C1.2	A387 Gr.11 C1.2	A387 Gr.11 C1.2	A387 Gr.11 C1.2
Shielding gas	80%Ar+20%CO ₂	80%Ar+20%CO ₂	80%Ar+20%CO ₂	80%Ar+20%CO ₂	80%Ar+20%CO ₂	80%Ar+20%CO ₂	80%Ar+20%CO ₂
Chemical composition (% by mass)	C	0.047	0.047	0.047	0.048	0.053	0.050
	Si	0.36	0.36	0.35	0.40	0.42	0.39
	Mn	0.87	0.87	0.85	0.84	0.77	0.90
	P	0.007	0.007	0.007	0.007	0.007	0.007
	S	0.009	0.009	0.009	0.009	0.009	0.009
	Cu	0.015	0.015	0.015	0.015	0.015	0.015
	Ni	0.015	0.015	0.015	0.015	0.015	0.015
	Cr	1.11	1.11	1.06	1.32	1.30	1.23
	Mo	0.43	0.42	0.42	0.42	0.49	0.46
	Al	0.002	0.002	0.002	0.002	0.002	0.013
	Ti	0.089	0.088	0.088	0.088	0.042	0.040
	Nb	0.003	0.003	0.003	0.003	0.003	0.002
	V	0.007	0.007	0.007	0.007	0.007	0.005
	B	0.0124	0.0132	0.0037	0.0037	0.0009	0.0045
	N	0.009	0.008	0.003	0.032	0.012	0.013
Test results	Usability,	Good	Good	Good	Bad	Good	Bad
	Radiographic examination*	JIS Class 1 or below (HC)	JIS Class 1 or below (HC)	JIS class 1	JIS Class 1 or below (BH)	JIS class 1	JIS class 1
	Tensile strength (MPa)	674	675	563	649	652	673
	0.2%-Offset yield strength (MPa)	569	558	567	538	559	569
	Elongation (%)	25	24	25	22	25	25
	2 mmVE-18°C (Avg. J)	67	57	33	15	11	59
	Ferrite band suppression	Acceptable	Acceptable	Unacceptable	Acceptable	Unacceptable	Unacceptable

*HC: Hot cracking, BH: Blow holes

Table 18

Flux-cored wire	Comparative example 23	Comparative example 24	Comparative example 25	Comparative example 26	Comparative example 27	Comparative example 28	Comparative example 29
Designation of material of plates	A387 Gr.11 C1.2	A387 Gr.11 C1.2	A387 Gr.11 C1.2	A387 Gr.11 C1.2	A387 Gr.11 C1.2	A387 Gr.11 C1.2	A387 Gr.11 C1.2
Shielding gas	80%Ar+20%CO ₂	80%Ar+20%CO ₂	80%Ar+20%CO ₂	80%Ar+20%CO ₂	80%Ar+20%CO ₂	80%Ar+20%CO ₂	80%Ar+20%CO ₂
Chemical composition (% by mass)	C	0.042	0.048	0.056	0.057	0.050	0.049
	Si	0.41	0.36	0.44	0.05	0.39	0.38
	Mn	0.91	0.85	0.93	0.37	0.82	0.93
	P	0.007	0.007	0.007	0.007	0.007	0.007
	S	0.009	0.009	0.009	0.010	0.009	0.009
	Cu	0.015	0.015	0.015	0.015	0.015	0.015
	Ni	0.015	0.015	0.015	0.015	0.015	0.015
	Cr	1.32	1.13	1.36	1.33	1.22	1.25
	Mo	0.47	0.43	0.53	0.53	0.46	0.46
	Al	0.002	0.002	0.002	0.002	0.006	0.002
	Ti	0.116	0.046	0.100	0.045	0.048	0.096
	Nb	0.003	0.003	0.003	0.002	0.002	0.003
	V	0.009	0.009	0.009	0.007	0.005	0.009
	B	0.0045	0.0009	0.0041	0.0009	0.0044	0.0135
	N	0.012	0.011	0.013	0.012	0.013	0.033
Usability,	Good	Bad	Bad	Bad	Bad	Bad	Bad
Radiographic examination*	JIS Class 1 or below (SI)	JIS Class 1 or below (BH)	JIS class 1	JIS Class 1 or below (BH)	JIS Class 1	JIS Class 1 or below (BH)	JIS Class 1 or below (BH, HC)
Tensile strength (MPa)	679	654	665	532	573	712	673
0.2%-Offset yield strength (MPa)	585	560	573	445	485	625	565
Elongation (%)	26	26	25	23	25	18	21
2 mmVE-18°C (Avg. J)	38	13	65	13	69	18	13
Ferrite band suppression	Acceptable	Unacceptable	Acceptable	Unacceptable	Unacceptable	Acceptable	Acceptable

HC: Hot cracking BH: Blow holes SI: Slug inclusion

Table 19

Flux-cored wire	Example 1	Example 2	Example 3	Example 4	Example 5	Example 6	Example 7
Designation of material of plates	A387 Gr.11 C1.2	A387 Gr.11 C1.2	A387 Gr.11 C1.2	A387 Gr.11 C1.2	A387 Gr.11 C1.2	A387 Gr.22 C1.2	A204 Gr. A
Shielding gas	80%Ar+20%CO ₂	80%Ar+20%CO ₂	100%CO ₂	100%CO ₂	100%CO ₂	80%Ar+20%CO ₂	80%Ar+20%CO ₂
Chemical composition (% by mass)	C	0.147	0.043	0.044	0.054	0.053	0.043
	Si	0.53	0.08	0.73	0.37	0.24	0.41
	Mn	0.46	0.88	0.57	0.41	1.12	0.78
	P	0.012	0.007	0.007	0.007	0.007	0.007
	S	0.013	0.010	0.009	0.010	0.010	0.009
	Cu	0.018	0.015	0.015	0.015	0.015	0.015
	Ni	0.018	0.015	0.015	0.015	0.015	0.015
	Cr	1.08	1.24	1.19	1.44	1.44	1.11
	Mo	0.42	0.49	0.48	0.58	0.58	0.52
	Al	0.003	0.002	0.003	0.002	0.002	0.002
	Ti	0.088	0.088	0.078	0.099	0.099	0.080
	Nb	0.003	0.003	0.002	0.002	0.002	0.003
	V	0.007	0.007	0.006	0.008	0.008	0.007
	B	0.0043	0.0043	0.0043	0.0052	0.0052	0.0042
	N	0.011	0.011	0.011	0.013	0.013	0.013
Test results	Usability.	Good	Good	Good	Good	Good	Good
	Radiographic examination	JIS class 1	JIS class 1	JIS class 1	JIS class 1	JIS class 1	JIS class 1
	Tensile strength (MPa)	682	673	685	685	683	579
	0.2%-Offset yield strength (MPa)	595	595	594	598	589	483
	Elongation (%)	20	25	22	25	24	26
	2 mmVE-18°C (Avg. J)	120	109	110	108	125	82
	Ferrite band suppression	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable

Table 20

Flux-cored wire	Example 8	Example 9	Example 10	Example 11	Example 12	Example 13	Example 14
Designation of material of plates	A387 Gr. 22 C1.2	A387 Gr.11 C1.2	A387 Gr.11 C1.2	A387 Gr.11 C1.2	A387 Gr.11 C1.2	A387 Gr.11 C1.2	A387 Gr.11 C1.2
Shielding gas	100%CO ₂	80%Ar+20%CO ₂	100%CO ₂	80%Ar+20%CO ₂	80%Ar+20%CO ₂	80%Ar+20%CO ₂	80%Ar+20%CO ₂
Chemical composition (% by mass)	C	0.077	0.059	0.057	0.048	0.055	0.055
	Si	0.40	0.69	0.47	0.44	0.58	0.58
	Mn	0.86	1.01	0.98	0.73	0.98	0.89
	P	0.012	0.007	0.007	0.007	0.007	0.007
	S	0.015	0.009	0.009	0.009	0.009	0.009
	Cu	0.017	0.015	0.015	0.015	0.015	0.015
	Ni	0.018	0.015	0.015	0.015	0.015	0.015
	Cr	2.31	1.40	1.19	1.11	1.23	1.30
	Mo	1.17	0.53	0.52	0.45	0.51	0.51
	Al	0.003	0.020	0.002	0.002	0.002	0.002
	Ti	0.095	0.114	0.095	0.083	0.115	0.110
	Nb	0.002	0.003	0.007	0.003	0.002	0.002
	V	0.008	0.007	0.013	0.007	0.007	0.007
	B	0.0051	0.0045	0.0045	0.0014	0.0104	0.0050
	N	0.012	0.013	0.016	0.006	0.020	0.028
Usability,	Good	Good	Good	Good	Good	Good	Good
Radiographic examination	JIS class 1	JIS class 1	JIS class 1	JIS class 1	JIS class 1	JIS class 1	JIS class 1
Tensile strength (MPa)	716	673	663	661	681	653	679
0.2%-Offset yield strength (MPa)	623	591	572	562	578	562	567
Elongation (%)	25	25	25	27	24	27	23
2 mmVE-18°C (Avg. J)	118	108	92	62	75	89	76
Ferrite band suppression	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable
Test results							

Table 21

Flux-cored wire	Example 15	Example 16	Example 17	Example 18	Example 19	Example 20	Example 21
Designation of material of plates	A387 Gr.11 C1.2	A387 Gr.11 C1.2	A387 Gr.11 C1.2	A387 Gr.11 C1.2	A387 Gr.11 C1.2	A387 Gr.11 C1.2	A387 Gr.11 C1.2
Shielding gas	80%Ar+20%CO ₂	80%Ar+20%CO ₂	80%Ar+20%CO ₂	80%Ar+20%CO ₂	80%Ar+20%CO ₂	80%Ar+20%CO ₂	80%Ar+20%CO ₂
Chemical composition (% by mass)	C	0.049	0.073	0.053	0.052	0.055	0.058
	Si	0.61	0.43	0.39	0.38	0.43	0.40
	Mn	0.85	0.82	0.89	0.88	0.92	0.82
	P	0.007	0.012	0.008	0.007	0.007	0.007
	S	0.009	0.013	0.010	0.009	0.009	0.009
	Cu	0.015	0.017	0.015	0.015	0.015	0.015
	Ni	0.015	0.017	0.015	0.015	0.015	0.015
	Cr	1.30	1.30	1.23	1.21	1.34	1.25
	Mo	0.51	0.51	0.51	0.50	0.52	0.50
	Al	0.002	0.003	0.002	0.002	0.002	0.002
	Ti	0.113	0.109	0.073	0.135	0.113	0.087
	Nb	0.002	0.002	0.002	0.003	0.002	0.002
	V	0.007	0.007	0.005	0.008	0.007	0.005
	B	0.0045	0.0045	0.0050	0.0044	0.0046	0.0045
	N	0.007	0.006	0.020	0.020	0.013	0.021
Test results	Usability,	Good	Good	Good	Good	Good	Good
	Radiographic examination	JIS class 1	JIS class 1	JIS class 1	JIS class 1	JIS class 1	JIS class 1
	Tensile strength (MPa)	649	665	647	673	660	662
	0.2%-Offset yield strength (MPa)	538	561	552	569	553	565
	Elongation (%)	28	26	24	22	24	24
	2 mmVE-18°C (Avg. J)	95	88	84	76	113	82
	Ferrite band suppression	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable

Table 22

Flux-cored wire	Example 22	Example 23	Example 24	Example 25	Example 26	Example 27	Example 28
Designation of material of plates	A387 Gr.11 C1.2	A387 Gr.11 C1.2	A387 Gr.11 C1.2	A387 Gr.11 C1.2	A387 Gr.11 C1.2	A387 Gr.11 C1.2	A387 Gr.11 C1.2
Shielding gas	80%Ar+20%CO ₂	98%Ar+20%CO ₂	80%Ar+20%CO ₂	80%Ar+20%CO ₂	80%Ar+20%CO ₂	80%Ar+20%CO ₂	80%Ar+20%CO ₂
Chemical composition (% by mass)	C	0.067	0.059	0.061	0.058	0.051	0.051
	Si	0.46	0.63	0.48	0.54	0.49	0.49
	Mn	0.94	1.10	0.94	0.92	0.90	0.71
	P	0.008	0.004	0.004	0.004	0.004	0.007
	S	0.009	0.014	0.014	0.014	0.013	0.009
	Cu	0.015	0.017	0.017	0.017	0.017	0.015
	Ni	0.015	0.063	0.061	0.062	0.064	0.015
	Cr	1.46	1.30	1.21	1.28	1.23	2.15
	Mo	0.58	0.56	0.56	0.55	0.55	0.97
	Al	0.002	0.002	0.002	0.002	0.002	0.002
	Ti	0.135	0.104	0.114	0.100	0.081	0.076
	Nb	0.003	0.003	0.002	0.002	0.003	0.002
	V	0.008	0.010	0.009	0.009	0.010	0.006
	B	0.0053	0.0043	0.0049	0.0043	0.0034	0.0045
	N	0.024	0.016	0.017	0.023	0.014	0.017
Usability,	Good	Good	Good	Good	Good	Good	Good
Radiographic examination	JIS class 1	JIS class 1	JIS class 1	JIS class 1	JIS class 1	JIS class 1	JIS class 1
Tensile strength (MPa)	672	659	662	667	672	680	721
0.2%-Offset yield strength (MPa)	574	549	553	559	562	579	630
Elongation (%)	23	24	25	24	26	24	26
2 mmVE-18°C (Avg. J)	78	79	88	81	65	68	63
Ferrite band suppression	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable

Table 23

Flux-cored wire	Example 29	Example 30	Example 31	Example 32	Example 33	Example 34	Example 35
Designation of material of plates	A387 Gr.22 C1.2	A387 Gr.22 C1.2	A387 Gr.22 C1.2	A387 Gr.22 C1.2	A387 Gr.22 C1.2	A387 Gr.11 C1.2	A387 Gr.11 C1.2
Shielding gas	80%Ar+20%CO ₂	80%Ar+20%CO ₂	80%Ar+20%CO ₂	80%Ar+20%CO ₂	80%Ar+20%CO ₂	80%Ar+20%CO ₂	80%Ar+20%CO ₂
Chemical composition (% by mass)	C	0.073	0.071	0.074	0.066	0.053	0.061
	Si	0.73	0.50	0.57	0.51	0.51	0.67
	Mn	0.75	0.75	0.77	0.91	0.90	0.91
	P	0.007	0.007	0.007	0.007	0.007	0.007
	S	0.009	0.010	0.010	0.010	0.009	0.009
	Cu	0.015	0.015	0.015	0.018	0.015	0.015
	Ni	0.015	0.015	0.015	0.038	0.015	0.015
	Cr	2.24	2.24	2.32	2.05	1.13	1.24
	Mo	1.04	1.04	1.08	1.10	0.44	0.52
	Al	0.002	0.002	0.002	0.002	0.002	0.002
	Ti	0.082	0.100	0.104	0.107	0.088	0.106
	Nb	0.002	0.002	0.002	0.002	0.003	0.003
	V	0.007	0.007	0.007	0.010	0.007	0.008
Test results	B	0.0049	0.0034	0.0036	0.0036	0.0046	0.0053
	N	0.018	0.018	0.019	0.016	0.008	0.009
	Usability,	Good	Good	Good	Good	Good	Good
	Radiographic examination	JIS class 1	JIS class 1	JIS class 1	JIS class 1	JIS class 1	JIS class 1
	Tensile strength (MPa)	732	742	748	746	675	678
	0.2%-Offset yield strength (MPa)	641	651	653	655	573	569
	Elongation (%)	26	26	25	25	24	25
	2 mmVE-18°C (Avg. J)	81	83	89	89	132	110
Ferrite band suppression		Acceptable	Acceptable	Acceptable	Acceptable	Acceptable	Acceptable